Utilizing Food Residuals in Compost Operations "A Review of Systems and Management"

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FOOD RESIDUALS UTILIZATION OPTIONS:

"Higher and Better Uses"

- **DIRECT FEED**
  - -cooked produce and meat scraps to hogs and cows
  - -Bread residuals to Cows
- **COMPOSTING**
  - -Rich "Humus-like" Material organic matter/landscaping
- **LAND APPLICATION**
  - -applied agronomically (fertilizer) nitrogen, phosphorus, potassium

Comparison of Maine Disposal Costs

- Landfill Disposal $65-85/ton*
  *Extra if Putrescible
- Composting $30 to $45/ton

Trucking Costs can Skew this!!!

Composting Benefits

- Low cost/low tech approach
- 40% reduction in initial residual volume
- Reduction in odor and leachate potential
- Stable, odorless, marketable soil additive

Feedstocks--Questions You Should Ask

- What's available in the area? How Much?
- How far away? Do I need to transport?
- Will the "Generating" facility pay a "tip" fee?
- Are the volumes predictable or seasonal?
- Does the facility have storage space?
- Are there any handling concerns?
  - Liquid vs. Dry
  - Putrescible/odors
- Do I need to modify the feedstock to use it?


Food Waste
"What's in a Name?"
"Everything!!"
Food Residual

Recipe Development

- Analyze and handle Feedstocks
  - Determine nutrient values (N,P,K,C, C:N)
  - %solids or total moisture content
  - Volatile Solids

- Formulate Recipe
  - Carbon to Nitrogen Ratio (25:1 to 30:1)
  - Moisture (45%-60%)
  - Porosity (maximize airspace/limit drying)
  - Thorough Mixing (Homogeneous)

Four Elements Necessary for Successful Composting

- ***Carbon**- micro organisms need this for energy and growth
- ***Nitrogen**- micro organisms need this for protein and reproduction
- ***Oxygen**- above 5% needed to support micro organisms …. Air has 21% Oxygen
- ***Moisture**- 40% to 65% needed for healthy environment….. Below 15%, all activity ceases

Mixing


60
DRESSER

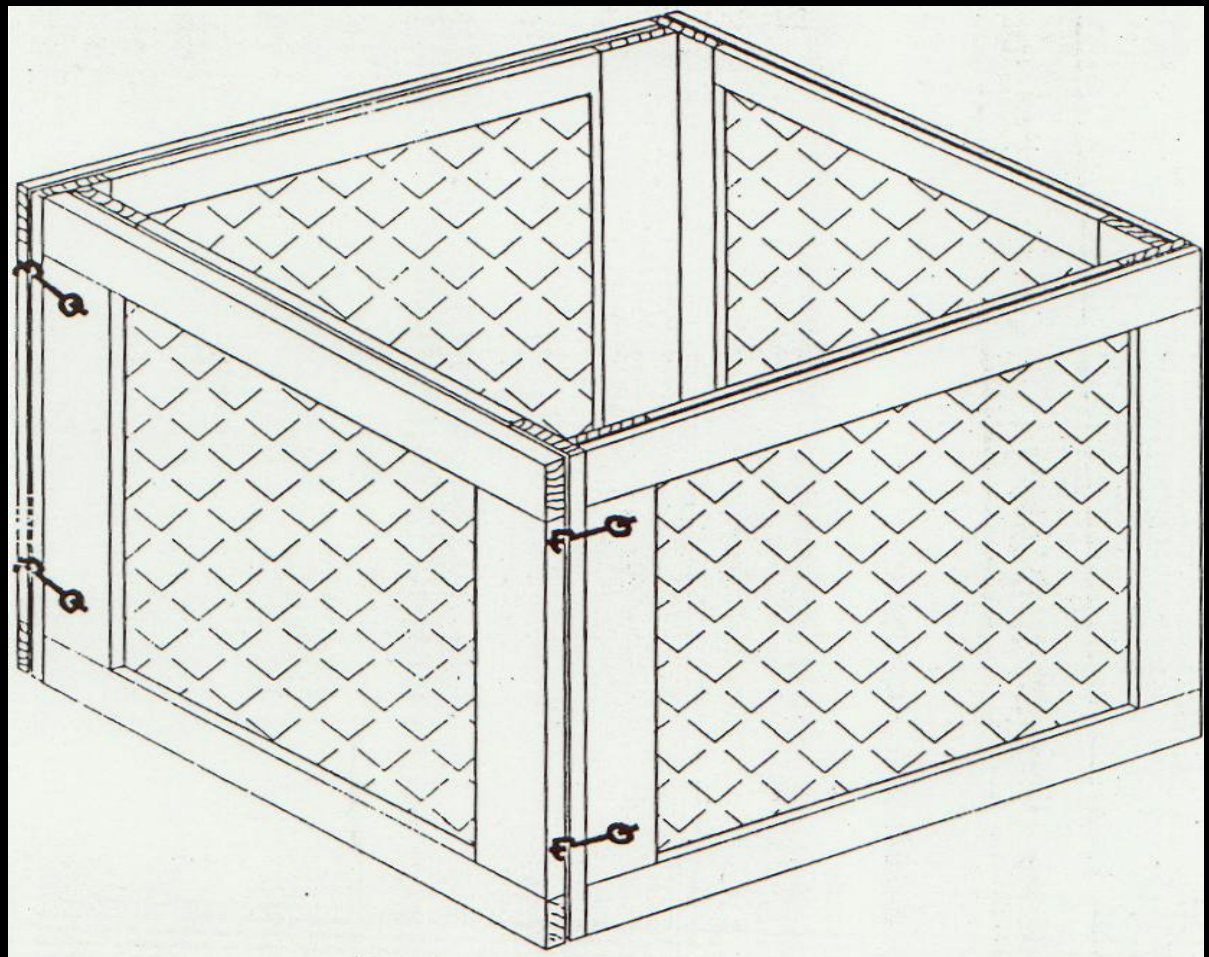

Reel Auggie
CAUTION
1 13'98


SSI

Compost Systems of Interest to YOU!!!

Backyard Systems

- Inexpensive to buy and operate
- Relatively “Hands-Free”
- Low Maintenance
- Small Capacity
- Limited to simple feedstocks (see below)
- Prone to Vector Attraction when using putrescible feedstocks



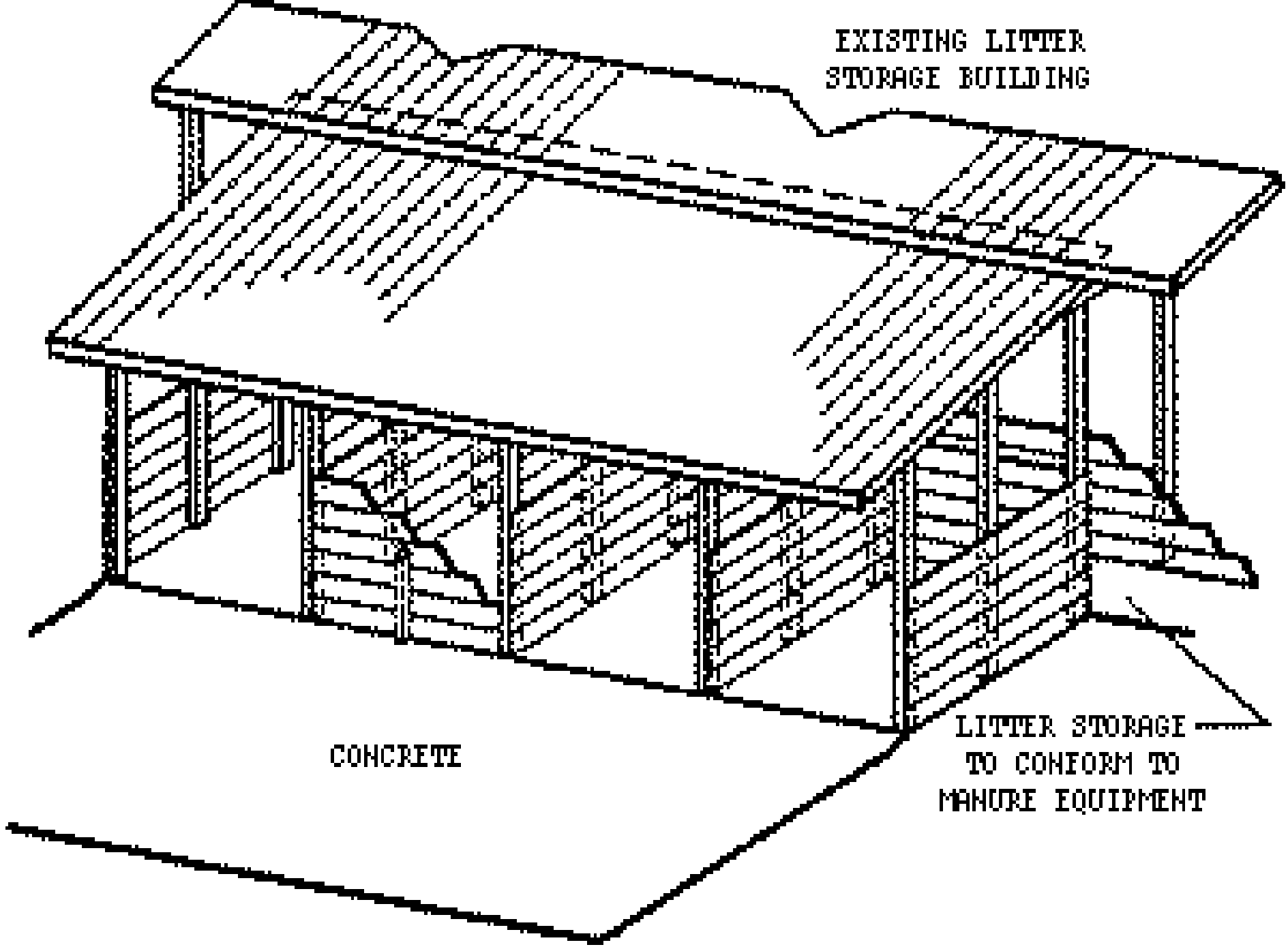
BACKYARD COMPOST BIN

Bin "Maryland" System

- Originally designed at the University of Maryland Agricultural Experiment Station.
- Series of Wooden Bins (Primary and Secondary).
- Litter, Straw, and Dead Birds (Poultry) are added in successive layers (2:1:1).
- Final layer of dry litter to discourage flies.
- Water is liberally added (40%).
- After 10 days material turned into 2nd bin.
- After total 20 days process is done.

Bin "Maryland" System (Cont.)

- Inexpensive to build and operate
- Designed for small scale applications.
- Layering and turning can be labor intensive.
- Produces "Crude" compost suitable for crop use.


EXISTING LITTER
STORAGE BUILDING
CONCRETE
LITTER STORAGE
TO CONFORM TO
MANURE EQUIPMENT

Static Pile

- Compost ingredients simply stacked into a pile and left to decompose.
- Least labor intensive, piles turned 4X/yr.
- Least expensive method. Minimal Equipment (Front-end loader).
- Piles require long time to finish composting.
- Piles must be thoroughly mixed to ensure “Aerobic Composting”.
- Potential for odor generation.
- Usually used for leaves and manure.

Turned Windrow

- Involves placing compost ingredients into long narrow piles (windrows) and then subsequently turning them at regular intervals.
- Typical dimension 3-6 feet high by 10-12 feet long.
- Turning provides aeration, rebuilds porosity, and aids in physical breakdown of ingredients.
- Windrows require temperature monitoring to measure pile activity and determine turning frequencies.

Turned Windrow

- Can be management intensive.
  - **Monitoring**
  - **Turning**
- Piles can be turned using either a frontend loader or windrow turner

Front end Loader vs. Turner

- Front end loader works well for small scale operations (<500 cubic yd/yr).
  - >500 cubic yd/yr, loader tends to be time intensive, whereas turner can accomplish task in half the time.
- Turner physically agitates ingredients, loader tends to form “Balls”.
- Turner represents additional cost, most facilities have front end loader.

In-Vessel

- Most expensive option.
- Allows all facets of operation to be enclosed.
- Odors are captured and treated in Biofilter.
- Allows you to optimize the process through continuous monitoring feedback and process control.
- Fastest compost time.
- Required “Routine” Maintenance.

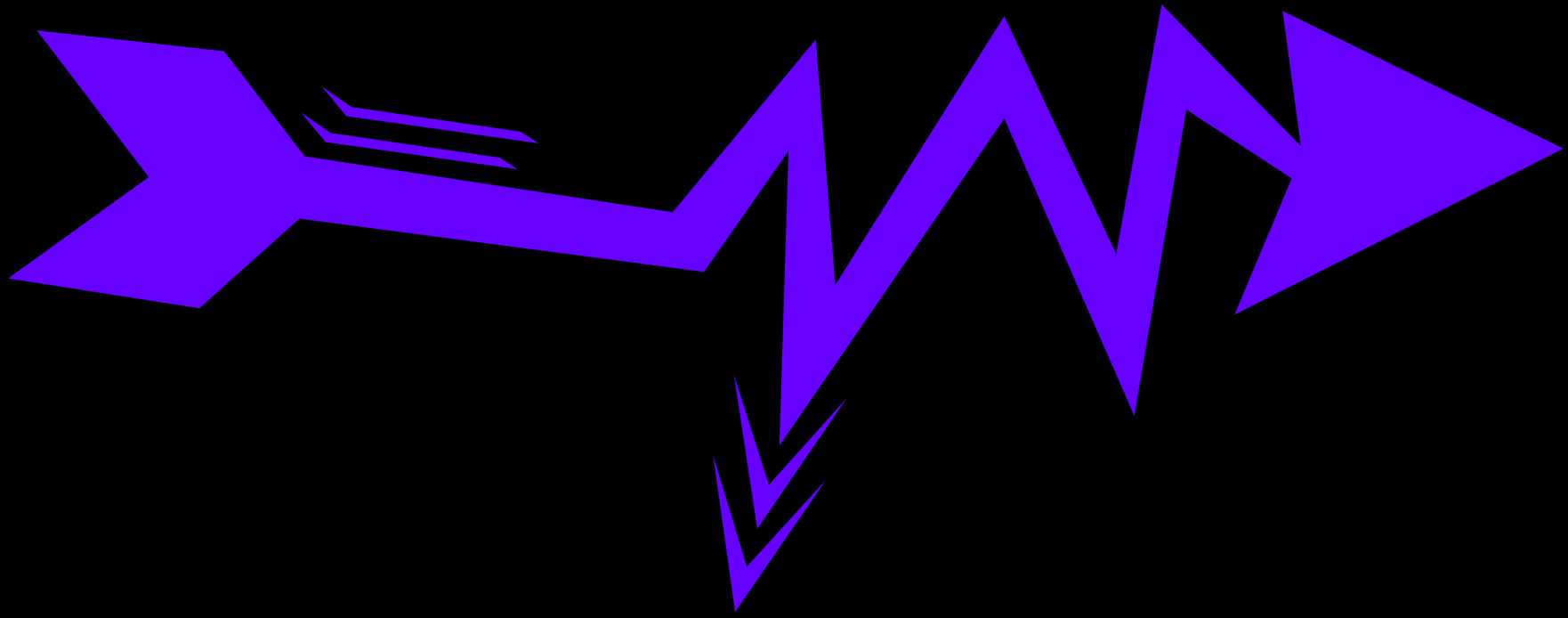

Loading Hatch
Mixing Auger


G

Picking The "Right" System

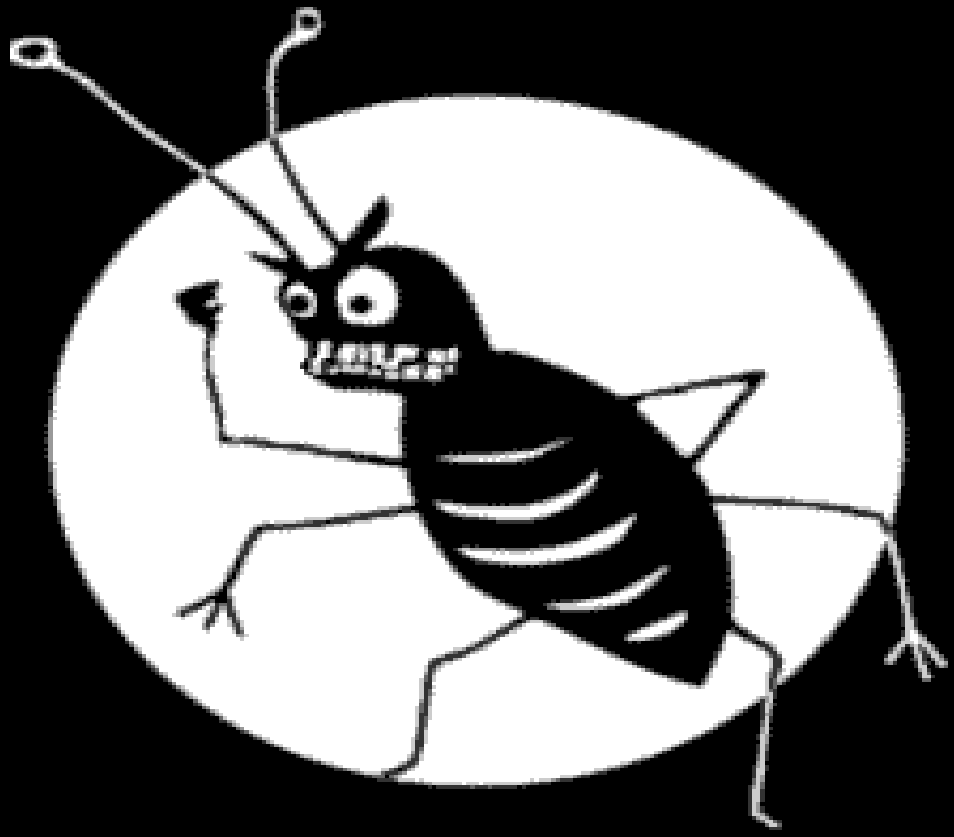
- Answer the Feedstock Questions.
  - Handling Issues
  - Tip Fees
- Determine your Annual Volume Cap.
- Develop a "Financial Plan"
  - Capital for Equipment, Labor, Storage, etc.
- Determine the End-Use For the Finished Product.
- View as Many "Real-life" situations as you can.

NUISANCE Problems



Nuisance Problems

- ODORS!
- Vectors
  - Birds
  - Insects
  - Mammals
- Leachate



ODOR PROPERTIES

CHARACTER

CONCENTRATION

INTENSITY

HEDONIC TONE

ODOR MANAGEMENT

INCORPORATION

PROCESS CONTROL

- -OPTIMIZE RECIPE (C:N 25:1 TO 30:1)
- -POROSITY
- -MOISTURE (45-60%)
- -HOMOGENEOUS MIXTURE

PILE COVERING--4-6 INCH (10-15 CM) LAYER OF FINISHED COMPOST, PEAT OR SAWDUST ACTS AS A “MINI-SCRUBBER”

VECTORS


University of Nebraska
Department of Entomology


University of Nebraska
Department of Entomology

DISCOURAGE VECTORS BY…..

-NEAT AND CLEAN OPERATION

-GRINDING AND INCORPORATION

-THOROUGH MIXING

-PROCESS CONTROL


Leachate


•Liquid loss of nutrients from compost pile
•Can be caused by:
• poor mixing
• inadequate recipe
• precipitation
Threat to ground and surface waters!!

Solving Compost Problems

- Remember these are “People Problems”

- Respond to complaints ASAP

- Address Odors, leachate and Vectors by:
  - -maintaining a neat and clean operation
  - -strict process control
    - -C:N (25:1 to 30:1)
    - -moisture (45% to 60%)
    - -porosity (adequate “free” air space)
    - -mixture (Homogeneous)

Navigating the Application Process

The Process

- Chapter 410, *Composting Facilities (effective February 18, 2009)*
- Type of application filed will depend on:
  - What type of feedstocks will be used?
  - How much material will be composted annually?
  - What is the potential threat to public health and the environment?
  - Whether the facility meets certain requirements
- Applicable Rules, Forms and Fees may be found at:
  - http://www.maine.gov/dep/rwm/solidwaste/#ru

Type of Feedstocks

- Type IA
  - C:N ratio greater than 25:1
  - Leaf & yard waste, wood chips, some vegetative waste
- Type IB
  - C:N ratio greater than 15:1 but less than 25:1
  - Animal manure, most produce and vegetable waste
- Type IC
  - C:N ratio less than 15:1
  - Fish waste

Type IA

Type IB

Type IC

Type of Application

- Exemptions to licensing requirements
- Five types of applications
  - Pilot Project
  - Permit-By-Rule (PBR)
  - Reduced Procedure - if facility doesn’t meet PBR requirements
  - General Procedure (usually large-scale/commercial)

Chapter 410 General Exemptions

- Facilities that, in any thirty (30) consecutive day period, receive for composting less than:
  - Ten (10) cubic yards of Type IA residuals;
  - Five (5) cubic yards of Type IB residuals; or
  - Five (5) cubic yards of Type IC residuals;
- The composting of solid waste during a Department-supervised remediation, emergency response, or research project; and
- Composting toilets as defined the in *Maine Subsurface Wastewater Disposal Rules*, 10-144 CMR 241(1004)(0).

Chapter 410 Agricultural Exemptions

- Facilities that compost domestic animal and poultry carcasses in accordance with Department of Agriculture Carcass Disposal Rules.
- Facilities that compost 10,000 cubic yards or less of animal manure per year;
- Agricultural Composting Operations that, in any thirty (30) consecutive day period, compost a total of between five (5) and thirty (30) cubic yards of Type IB and IC residuals, and have a Compost Management Plan approved by the Maine Department of Agriculture, Food and Rural Resources;
- Agricultural Composting Operations that compost any volume of Type IA, Type IB or Type IC waste provided that at least 70% of the finished compost product is used at appropriate agronomic rates on the farm;
- Agricultural Composting Operations that use leaves as an amendment to compost manure;
- Agricultural Composting Operations that compost offal;

Pilot Project

- To collect technical information
  - Environmental feasibility
  - Financial feasibility
- Intended for trying a proven technology in a new setting

Permit-By-Rule

- Section 5 of Chapter 410
- Leaf and yard waste only
- Facility <3 acres
- Public notification
- Submit application and it is automatically approved unless denied within 15 working days

Reduced Procedure

- Section 6 of Chapter 410
- Includes:
  - Any Volume of Type IA
  - Up to 400 yds^3 monthly of Type IB
  - 200 yds^3 monthly of Type IC or **Type II**
- Suitable “Working Surface”
- Impervious Mixing Pad
  - Whole Compost Operation on impervious surface for greater than 750 yds^3 Type IC, annually
- Public notification
- Submit application--on approved forms

Application Fees

- Pilot Project $132
- Permit-By-Rule $264
- Reduced Procedure / General Procedure
  - Type IB and IC <750 yds^3/year $422
  - Type IB and IC ≥750 yds^3/year $422


100
80
120
60
140
REOTEM
40
160
°F
20
180
0
200
REOTEMP
INST CORP.
CAIF. U.S.A.

SUMMARY

GOOD SITING AND STRICT PROCESS CONTROL CAN HELP MAXIMIZE FACILITY EFFICIENCY WHILE HELPING TO AVOID NUISANCES

Questions??!!